

What is claimed is:

1. A battery protection circuit, comprising:
 - a. at least one rechargeable cell;
 - b. a safety circuit coupled to the at least one rechargeable cell, the safety
 5 circuit comprising a voltage monitoring circuit and a current monitoring
 circuit;
 - c. at least one disconnect element coupled serially with the at least one
 rechargeable cell;
 - d. a charge monitoring circuit; and
 - 10 e. a circuit for simulating an overcurrent condition within the safety circuit
 when the charge monitoring circuit determines that a rechargeable cell
 parameter selected from the group consisting of power, voltage,
 temperature, pressure and energy exceeds a predetermined threshold.
2. The circuit of claim 1, wherein the charge monitoring circuit comprises a power
 15 monitoring circuit.
3. The circuit of claim 2, wherein the charge monitoring circuit comprises a pulsed
 current detector.
4. The circuit of claim 3, further comprising at least a second disconnect element,
 the at least a second disconnect element being responsive to the charge monitoring
 20 circuit.
5. The circuit of claim 4, further comprising a leakage current path in parallel with
 the at least a second disconnect element, the leakage current path having a
 resistance in excess of one hundred thousand Ohms.

6. The circuit of claim 1, further comprising at least a third disconnect element coupled between the at least one rechargeable cell and the charge monitoring circuit, wherein when the overcurrent condition is simulated, the safety circuit actuates the at least a third disconnect element to deactivate the charge monitoring circuit.
7. The circuit of claim 1, wherein the at least one disconnect element is selected from the group consisting of transistors, switches, relays, circuit breakers, and fuses and positive temperature coefficient devices.
8. The circuit of claim 3, wherein the pulsed current detector circuit comprises:
 - a. a comparator having at least a pair of inputs, wherein a voltage proportional to the current flowing to or from the at least one rechargeable cell is coupled to a first input;
 - b. a capacitor coupled to the first input; and
 - c. a reference voltage coupled to a second input;wherein an output of the comparator is in a first state when the first input is at a level below the second input; further wherein the output of the comparator is in a second state when the first input is at a level above the second input.
9. The circuit of claim 1, wherein the predetermined threshold is 1.2 micro coulombs.
10. The circuit of claim 9, wherein the predetermined threshold is 9 watts.
11. The circuit of claim 1, wherein the safety circuit comprises:
 - a. an overcharge detector;
 - b. an undercharge detector; and

c. an overcurrent detection circuit.

12. The circuit of claim 11, wherein the overcurrent situation is simulated by sourcing current into the overcurrent detection circuit.

13. A rechargeable battery pack comprising the circuit of claim 1.

5 14. A battery protection circuit having a charge monitoring circuit, wherein the charge monitoring circuit determines when a charge parameter exceeds a predetermined threshold, comprising:

a. at least one rechargeable cell;

b. at least one safety circuit coupled to the at least one rechargeable cell;

10 c. at least one switch coupled serially with the at least one rechargeable cell; and

d. at least one circuit for simulating an overcurrent condition within the safety circuit when the charge monitoring circuit determines that the charge parameter exceeds the predetermined threshold.

15 15. The circuit of claim 14, wherein when the at least one means for simulating an overcurrent condition within the safety circuit simulates an overcurrent condition, the at least one switch enters a high impedance state.

16. The circuit of claim 15, wherein the at least one switch is selected from the group consisting of transistors, switches, relays, circuit breakers, and fuses and positive
20 temperature coefficient devices.

17. The circuit of claim 14, wherein the charge monitoring circuit comprises a pulsed current detector, the pulsed current detector comprising:

- a. an impedance for sensing the current flowing through the at least one rechargeable cell;
- b. a capacitor, wherein the capacitor integrates the sensed current flowing through the at least one rechargeable cell; and
- 5 c. a comparator, wherein the comparator determines whether the integrated, sensed current exceeds the predetermined threshold.

18. The circuit of claim 17, wherein an output of the comparator is in a first state when the integral of the sensed current flowing through the at least one rechargeable cell is below the predetermined threshold; further wherein the output
10 of the comparator is in a second state when the integral of the sensed current flowing through the at least one rechargeable cell is above the predetermined threshold.

19. The circuit of claim 17, wherein the predetermined threshold is 1.2 micro coulombs.

15 20. The circuit of claim 17, wherein the safety circuit comprises:

- a. an overcharge detector;
- b. an undercharge detector; and
- c. an overcurrent detection circuit;

wherein the overcurrent situation is simulated by sourcing current into the
20 overcurrent detection circuit.